A Study on Vas Deference and Seminal Vesicle of Male Goats (Capra hircus)

Hamayun Khan¹, Muhammad Misri Rind², Ali Gohar³, Naushad Khan⁴, Mian Saeed Sarwar¹, Muhammad Kamal Shah¹ & Abid Ali⁵

ABSTRACT

Background: Reproductive activity of male animal is strongly associated with development of the testicle, the conductor channels and accessory sex gland. Vas deference may be considered the extra-testicular continuation from cauda of the epididymis, and it is the portion of the reproductive tract fundamentally associated with transportation of the sperm-containing fluid from each epididymis to the urethra for their finishing discharge. Non-ampulated part is further divided into: extra-abdominal portion along the caudal border of testes, up to the vaginal ring and abdominal portion started from the vaginal ring to ampullae. Accessory sex glands including vesicular gland and ampullae of vas deferens are characteristically essential for reproductive process. Gross morphometric features of anatomical structures of male reproductive tract in an animal make available a very valuable mechanism in understanding of several physiological and reproductive phenomena.

The current study aim at documenting baseline data on gross morphometric aspects of vas deference and seminal vesicle in adult male local nondescriptive goats in Pakistan ecology that could be utilized as reference values in evaluating their congenital defects and gross pathological abnormalities.

Materials, Methods & Results: Experiments were carried out on ampullated and non-ampullated segment of vas deference and seminal vesicle. A total of n = 100 local male goats of 2-3 years of age were selected for this study. Vas deference and seminal vesicles (accessory sex gland) were collected immediately after slaughter from local abattoirs. The non-ampullated segment of vas deference was further divided into abdominal and extra-abdominal segment. Specimens were dissected and washed with normal saline. Standard procedure was adopted for these morphometric features of vas deference and seminal vesicle by using vernier caliper, scale, non-stretchable thread and electronic weighing balance. The result demonstrated the mean length and diameter of right vas deferens from epididymis to inguinal ring were 20.36 ± 1.56 cm and 0.28 ± 0.04 cm whereas that of the left was 20.38 ± 1.61 cm and 0.28 ± 0.04 cm respectively. The mean length and diameter of right abdominal part of vas deferens from inguinal ring to start of ampullae were 8.44 ± 1.58 cm and 0.26 ± 0.03 cm and that of the left were 8.42 ± 1.63 cm and 0.26 ± 0.03 cm. Furthermore, the mean length and diameter of right ampullae were 4.59 ± 0.78 cm and 0.43 ± 0.06 cm and that of the left were 4.59 ± 0.78 cm 0.42 ± 0.06 cm. The mean length, breadth and thickness of right seminal vesicle recorded were 2.13 ± 0.36 cm, 1.42 ± 0.21 cm, 1.00 ± 0.25 cm and those of left were 2.11 ± 0.34 cm, 1.44 ± 0.26 cm and 1.01 ± 0.25 cm whereas mean weight of the right seminal vesicle was 2.10 ± 0.88 g and that of left was 2.11 ± 0.87 g.

Discussion: The current gross morphometric assessment of the various segment of vas deference and seminal vesicle indicated close resemblance in outline and dimension with those of various goat types from different region of the world. During current study, statistically no significant difference has been observed in gross morphometric characteristic among different portion of the vas deference in either side in these nondescriptive male goats. On the other hand, these results demonstrated significant increase in the length of right seminal vesicle (P < 0.05) than that of the left whereas no significant difference was observed among breadth, thickness and weight of right and left seminal vesicles of male goat.

Keywords: vas deference, seminal vesicle, male goat, gross morphometry.
INTRODUCTION

Successful reproduction is one of the most essential traits of economical significance to increase animal productivity and profitability. Essentiality of vas deference in reproductive process is well established; have major involvement in conservation of sperm configuration, maturation and continued existence with provision of an appropriate milieu for their survivalability, thus have a significant utility in male fertility \cite{4,5,18,19}. Recent appraisal of literature indicated that vas deference contained non-ampulated and ampulated parts \cite{2}. Non-ampulated part is further divided into: extra-abdominal portion along the caudal border of testes, up to the vaginal ring and abdominal portion started from the vaginal ring to ampullae. On the other hand, seminal gland is lateral evagination of vas deference and is regarded the most important male accessory genital paired glands in the body that are easily identified due to their knotted feature \cite{3,9,13}. Secretions of seminal vesicles are clear fluid containing buffer against excess acidity of the female genital tract and ample amount of nutrient that are associated with supporting and optimizing motility of sperm \cite{12}.

Recently, a great deal of attention has been paid to morphometric assessment of accessory genital glands in small ruminant including goats (\textit{Capra hircus}) and males sheep (\textit{Ovis aries}) in different region of the world \cite{10,15,16,21}. On the other hand, detailed description of the gross morphometry of extra-abdominal, abdominal and ampulated portion of vas deference has not been elucidated. Furthermore, the morphometric feature of the vas deference and seminal vesicle of the local goat in Pakistan has not been reported thus far despite their significant contribution in the subsistence of the farmers and low income population in different region of the country. A basic understanding of the morphometric characteristic of male reproductive tract and accessory sex gland would enhance reproductive accomplishment of the local goat population. Additionally, such a study provides the scientific basis for the proper understanding and identification of any abnormality in the reproductive organs. Currently gross morphometric aspects of testis have been reported in the adult local goat population in Pakistan environment \cite{11} whereas that of different segments of vas deference and seminal vesicles has not been elucidated in hitherto. Therefore, the essence of the current study was to document gross morphometric aspects of anatomical segments of vas deference and seminal vesicle in adult male local goats that could be utilized as reference values in evaluating their congenital defects and gross anatomical abnormalities.

MATERIALS AND METHODS

Experimental design

A total of n = 100 local male goats of 2-3 years of age were selected for this study. The vas deference and the seminal vesicles (accessory sex gland) were collected immediately after slaughter from local abatoirs. The specimens were dissected and washed with normal saline. Standard procedure was adopted for these morphometric features of the vas deference and seminal vesicle \cite{2,8} by using vernier caliper, scale, non-stretchable thread and electronic weighing balance. Vas deferens was first dissected from the tail of epididymis to the superficial opening of the inguinal canal which passes through the abdominal wall to form a inguinal ring, and the remaining portion of vas deference form inguinal ring to ampulla was also dissected and then both portions were straightened out for taking measurements. Likewise, the left and right seminal vesicle was studied grossly for the length, width and thickness using Vernier calipers and un-stretchable nylon thread whereas the glands were weighed using electronic digital weighing machine.

Statistical analysis

The statistics of gross morphometric data were analyzed using SPSS version 16 for various segments of vas deference and seminal vesicle of the male goats. Results were presented as mean ± SD. Dimensions and weight were analyzed between right and left sides. Comparison was made by applying Student’s paired \textit{t}-test between right and left vas deference and seminal vesicle. The level of statistical significance was set at \( P < 0.05 \).

RESULTS

The length and diameter of right vas deferens from epididymis to inguinal ring (extra-abdominal part) were 20.36 ± 1.55 cm and 0.28 ± 0.04 cm whereas those of the left were 20.38 ± 1.61 cm and 0.28 ± 0.04 cm (Table 1). The mean of length and diameter of right abdominal part of vas deferens from inguinal ring to ampullae were 8.44 ± 1.58 cm and 0.26 ± 0.03 cm and that of the left were 8.42 ± 1.63 cm and 0.26 ± 0.03 cm.
The mean length and diameter of right ampullae of vas deference were 4.59 ± 0.78 cm and 0.43 ± 0.06 cm whereas those of the left were 4.59 ± 0.78 cm 0.42 ± 0.06 cm. During current study, statistically no significant difference has been observed in the different portion of the vas deference in either side.

The mean length, breadth and thickness of right seminal vesicle of male goat were 2.13 ± 0.36 cm , 1.42 ± 0.21 cm , 1.00 ± 0.25 cm whereas that of the left were 2.11 ± 0.34 cm in length, 1.44 ± 0.26 cm in breadth and 1.01 ± 0.25 cm in thickness respectively (Table 2). Furthermore, the mean weight of right seminal vesicle was 2.10 ± 0.88 g and that of left was 2.11 ± 0.87 g respectively (Table 2). These results demonstrated significant increase in length of the right seminal vesicle (P < 0.05) than that of the left whereas no significant difference was recorded among breadth, thickens and weight of right and left seminal vesicles of male goat.

<table>
<thead>
<tr>
<th>Segments of the vas deference</th>
<th>Side</th>
<th>Length (cm)</th>
<th>Diameter (cm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Extra-abdominal part⁹</td>
<td>Right</td>
<td>20.36 ± 1.560</td>
<td>0.284 ± 0.035</td>
</tr>
<tr>
<td></td>
<td>Left</td>
<td>20.38 ± 1.617</td>
<td>0.284 ± 0.035</td>
</tr>
<tr>
<td>Abdominal part⁹</td>
<td>Right</td>
<td>8.44 ± 1.590</td>
<td>0.257 ± 0.032</td>
</tr>
<tr>
<td></td>
<td>Left</td>
<td>8.42 ± 1.632</td>
<td>0.257 ± 0.033</td>
</tr>
<tr>
<td>Ampulla of the vas deference</td>
<td>Right</td>
<td>4.59 ± 0.785</td>
<td>0.427 ± 0.060</td>
</tr>
<tr>
<td></td>
<td>Left</td>
<td>4.59 ± 0.787</td>
<td>0.424 ± 0.060</td>
</tr>
</tbody>
</table>

⁹: extra-abdominal part from tail of epididymis to inguinal ring; b: abdominal part from the inguinal canal to start of the ampullae; n: number of observations.

<table>
<thead>
<tr>
<th>Morphometric parameter</th>
<th>Side</th>
<th>Mean ± S.D</th>
<th>Range</th>
</tr>
</thead>
<tbody>
<tr>
<td>Length (cm)</td>
<td>Right</td>
<td>2.13 ± 0.36</td>
<td>1.6-3.2</td>
</tr>
<tr>
<td></td>
<td>Left</td>
<td>2.11 ± 0.35</td>
<td>1.5-3.1</td>
</tr>
<tr>
<td>Breadth (cm)</td>
<td>Right</td>
<td>1.42 ± 0.21</td>
<td>1.1-2.0</td>
</tr>
<tr>
<td></td>
<td>Left</td>
<td>1.44 ± 0.26</td>
<td>0.9-3.0</td>
</tr>
<tr>
<td>Thickness (cm)</td>
<td>Right</td>
<td>1.01 ± 0.25</td>
<td>0.5-1.5</td>
</tr>
<tr>
<td></td>
<td>Left</td>
<td>1.01 ± 0.25</td>
<td>0.5-1.45</td>
</tr>
<tr>
<td>Weight (g)</td>
<td>Right</td>
<td>2.09 ± 0.88</td>
<td>0.7-4.3</td>
</tr>
<tr>
<td></td>
<td>Left</td>
<td>2.11 ± 0.87</td>
<td>0.6-4.3</td>
</tr>
</tbody>
</table>

*Significant at 5% level; n: number of observations.

**DISCUSSION**

The gross morphometric finding on different segment of vas deference in this study was in line with those recently investigated in matured Gaddi goat and Black Bengal goats [2,23]. In matured Gaddi goat, gross morphometric feature of vas deference was investigated in relation with ampulated and non-ampulated part. The mean length of ampulated part was 5.71 ± 0.14 cm whereas the mean length of non-ampulated part was 34.55 ± 1.83 corresponded with the extra abdominal part 21.15 ± 0.94 cm in length and abdominal part 13.40 ± 0.89 cm in length. Recently reported morphometric assessment of vas deference in the normal male Black Bengal goats measured the length, width and weight of vas deference as 27.3 ± 0.2 cm, 0.6 ± 0.0 cm and 1.7 ± 0.0 g [23]. On the other hand, current finding in our study on gross morphometric aspects of vas deference was not corresponded with that observed in goat fetus during successful pregnancy [7]. The mean length of left and right vas deference of goat fetus was 76.41 ± 7.66 and 76.02 ± 7.77 mm.
whereas mean diameter of left and right was 1.03 ± 0.13 mm. The length and diameter of left ampullae was 12.92 ± 1.52 mm and 1.53 ± 0.13 mm whereas that of the right one was 10.75 ± 2.22 and 1.53 ± 0.13 mm [7]. The probable reason for variation in the gross morphometric value of the vas deference in the current study with that of [7] might be ascribed to difference in the age of the experimental animal.

Since accessory sex glands including the ampullae of the vas deference and seminal vesicle are characteristically essential components of male genital system in goats [2,6]. Also the potential role of ampullae has been associated with short term storage deposit for sperm before ejaculation [10]. Currently gross morphometric aspects of the ampulla have been explored extensively in goats and sheep. Results obtained in current study on gross morphometry of the ampullae were in close vicinity as recently reported in Iraqi buck, Barwari goat, Gaddi goat and Gaddi sheeps [10,16,22]. The anatomical parameters of the ampullae in Iraqi buck have mean length 4.87 ± 0.29 cm, mean width 0.62 ± 0.007 cm, mean weight 2.18 ± 0.007 g [10]. The mean length of right and left ampullae in Barwari goat has been recorded as 3.93 ± 0.18 cm and 3.73 ± 0.18 cm; the mean width for right and left 1.41 ± 0.10 cm and 1.45 ± 0.12 cm [16]. In Bakerwali goat, length of the right and left ampullae has been reported as 3.0-6.20 cm and 3.30-6.40 cm [22]. Furthermore, in another study on Gaddi goat and sheep, the length of ampulla 5.04 ± 0.11 cm in Gaddi goat and 5.00 ± 0.07 cm in Gaddi sheep has been explored [21]. Moreover, the length of ampulla of goat and sheep has been reported between 6.00 to 8.00 cm and diameter between 4.00 to 8.00 mm [14].

Gross morphometric aspects of seminal vesicle have been elucidated in goats in diverse environmental condition of the world. Current finding on gross morphometry of seminal vesicle were in line with results recently reported in Bakerwali, Gaddi and Iquqai goat [10,16,21]. In Bakerwali goat, the mean length of right and left seminal vesicles was 2.70 ± 0.16 cm and 2.56 ± 0.16 cm whereas mean width and thickness of both side of seminal vesicle was in range of 1.4 ± 0.08 to 1.51 ± 0.09 cm and thickness in the right seminal vesicle was 0.456 ± 0.08 cm to 1.26 ± 0.09 cm respectively. The weight was recorded as 3.79 ± 0.52 g in right and 3.90 ± 0.55 g in left [16]. Morphometric study carried on seminal vesicle of Gaddi goat indicated length, breadth, thickness and weight of seminal vesicle of gaddi goat as 2.58 ± 0.16 cm, 1.70 ± 0.08 cm, 1.06 ± 0.02 cm and 4.19 ± 0.34 g and in Gaddi sheep as 2.74 ± 0.11 cm, 1.80 ± 0.11 cm, 1.14 ± 0.02 cm and 4.30 ± 0.21 g, respectively [20]. On the other hand, the value of current morphometric parameter was lower than those reported on ram and buck from Iraq [10]. In Iraqi ram, the seminal vesicle have mean length 3.68 ± 0.05 cm, mean width 2.50 ± 0.06 cm, and mean weight 4.42 ± 0.15 g whereas in buck, man length, width and weight of the seminal vesicle gland was 3.61 ± 0.01; 2.44 ± 0.01 cm, and 4.18 ± 0.15 g respectively [10]. This variability might be due to different types of goat and sheep as well as better nutritional husbandry management.

CONCLUSION

In conclusion, this study illustrated the detailed gross morphometric aspects of different segments of the vas deference and seminal vesicle in the local male goats that could be used as reference values for clinical relevance in male reproductive anatomy and regional pathobiology of the male reproductive system in goats. Additional study would be considered essential to correlate these gross morphometric characteristic with histological feature of vas deference and seminal vesicle of local goat population to better understand their reproductive functional morphology.

REFERENCES


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Declaration of Interest. The authors declare no commercial or financial relationships that could be construed as a potential conflict of interest


